History Matters for the Export Decision

Plant Level Evidence from Turkish Manufacturing Industry [#]

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Abstract

We empirically investigate factors that influence the export decision using plant level data from Turkish manufacturing industry over 1990-96. Our results support the presence of sunk costs of entry to export markets. More importantly, however, the results show that the full history of export participation matters for the current export decision. While persistence in exporting helps lower the costs of re-entry today, there are diminishing returns to experience in export markets. Furthermore, for the current export decision recent export experience counts more than the experience further in the past. We also find that several plant characteristics such as the plant size as measured by employment, technology as measured by capital intensity and the share of imported machinery, the shares of female and administrative employees in total employment influence the export decision.

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***Keywords*:** Export decision, productivity, sunk costs, plant characteristics.

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I. Introduction

Since the early-1990s, there has been a growing body of empirical research focusing on developing country manufacturing sectors using plant level data. One of the areas of investigation has been differences between exporting and non-exporting plants, and the transition dynamics to becoming an exporter. Given the importance attributed to developing country export performance and the role of manufacturing sectors in industrial development it is not surprising that the topic has generated interest among academics and policy makers alike.

There are several important findings in the empirical literature on export activity. First finding concerns efficiency differences between exporting and non-exporting plants. In numerous studies using data from several different countries it is reported that exporting plants are more efficient than non-exporting plants (see Aw and Hwang 1995; Bernard and Jensen 1995; Chen and Tang 1987; Haddad 1993; Handoussa, Nishimizu, and Page 1986; Tybout and Westbrook 1995; Roberts, Sullivan, and Tybout 1995). This finding, however, is not very informative for policy design since it does not address potential simultaneity between exporting and productivity. This concern led to a second set of studies.

Bernard and Jensen (1995) and Chlerides, Lach and Tybout (1998) are first to analyze whether more productive firms become exporters (self-selection hypothesis) or exporting *causes* efficiency gains (learning-by-exporting hypothesis). The assertion in the learning-by-exporting hypothesis is that exporters become more productive overtime because export markets are far more competitive than domestic markets (Biesebroeck, 2001). Pressure to increase productivity is also intensified as developing country exporters face competition from other less-developed labor-abundant developing countries (Mody and Yilmaz, 2002). In the literature, there is only weak empirical support for the learning-by-exporting hypothesis. For example, while Delgado, Farinas and Ruano (2002) suggest that learning effects from exporting are limited to younger exporters, Bernard and Jensen (1999) and Chlerides, Lach and Tybout (1998) find only very weak evidence, if any, indicating that past history of exporting increases efficiency. The self-selection hypothesis, on the other hand, states that more productive firms self-select to enter the export market. Empirical results reported by Chlerides, Lach and Tybout (1998), Bernard and Jensen (1999) and Greenaway and Kneller (2004) indicate that increased plant efficiency increases the probability of becoming an exporter, supporting the self selection hypothesis.

Third significant finding in the literature concerns presence of sunk costs of entry into the export markets. Indeed, in their specifications of the export participation equation Roberts and Tybout (1997) and Chlerides, Lach and Tybout (1998) assume that there are sunk entry and exit costs in the export markets. These can be the costs of international marketing, establishing a distribution system, hiring employees with language skills, the cost of gathering information about the demand conditions in export markets, etc. Once these costs are incurred, they can not be recovered. In other words, entry costs are sunk costs. Empirical findings point to the presence of significant sunk costs. For example, Roberts and Tybout (1997) report that the previous year's export experience increases a plant's likelihood of exporting today by 60 percentage points.

In this paper we investigate export market participation decisions of Turkish manufacturing plants for the period from 1990 to 1996. Our formulation of the export market participation decision differs from Roberts and Tybout's (1997) formulation, who are interested in the effects of sunk costs on export market participation decision. Instead of just the sunk costs we are interested in studying how the history of a plant's export market participation affects the current export market participation decision. In other words, we ask whether the full history matters for the current export decision. Our framework allows us to differentiate not only between exporting and non-exporting plants, but also between plants that have different export market participation records.

In addition, we incorporate plant characteristics that are expected to have an impact on export participation decision. These plant characteristics are the size (as measured by employment), relative labor productivity, average wage rate, capital-labor ratio, share of imported machinery in the capital stock, foreign ownership share, foreign license use and the composition of labor force.

The results of our study strongly support the presence of sunk costs in the entry of Turkish manufacturing plants into the export markets. In our first major finding we show that the longer is the export market experience of a plant the higher its likelihood of exporting relative to a plant that has no prior export experience. Second, the more recent export market experience (at *t-1*) matters more for a plant's likelihood of export market participation than the export market experience further in the past (in our case, at *t-2*). Plants that have never exported before faces highest sunk costs when they enter the first time around. Plants that exported further in the past (at *t-2*) and stopped exporting in the meantime (at *t-1*) also face sunk costs of re-entry, which are not as high as costs of new entry.

The rest of the paper is organized as follows. In the next section, we briefly summarize Turkish export performance and policies to promote exports. In section III we present the data and the export decision model. In section IV the empirical model and results are reported and discussed. Section V concludes the paper.

II. Export Promotion and Export Performance of Turkey since 1980s

Following the oil price shocks Turkey was unable to make necessary adjustments in economic policy and ran into a foreign debt crisis as early as 1977. Following the chaotic years of 1978 and 1979, the Turkish government announced major macroeconomic reforms and stabilization measures on January 24, 1980. Along with other measures, the reform package entailed the devaluation of Turkish Lira by more than 50% and swift changes in the trade policy framework. The scope of the reforms was extended in the following years and Turkey embarked on an ambitious trade liberalization program as part of a complete overhaul of the country's inward-looking development strategy.

In order to increase exports from its very low level of $2.9 billion in 1980 (less than 5 percent of GNP), the government started to implement export promotion measures, including direct export subsidies, tax rebates, export credits, simplification of export procedures and maintaining a competitive real exchange rate. With the establishment of the Turkish Eximbank in 1987, the government support for exports gained a new dimension and credits and guarantee programs targeted the sectors with high export potential.

Total export subsidy provided by the government through the new export promotion system amounted to 17.2% of exports in 1980. According to Aktan's calculations, total subsidy continued to be high throughout the 1980s and reached as high as 33.8% in 1989. Uygur's (1998) calculations show that even though there was a slight decline in subsidies in the second half of 1980s, total subsidies through direct payments, export credits, duty and tax allowances never fall below 20% until 1994. The export support regime applied until January 1, 1996 was modified in compliance with the customs code of the European Community, and Turkey's other international commitments.

In addition to explicit export support measures, the government deliberately followed a policy of real devaluation of the Lira so that Turkish products would become more competitive in international as well as domestic markets. Between 1980 and 1984, the Lira depreciated by 44 percent in real terms. As a result of the direct and indirect incentives provided to exporters, total exports increased from $2.9 billion in 1980 to $7.1 billion in 1984, a 250 percent increase. The share of manufactured exports in total increased from 36 percent in 1980 to 72 percent in 1984.

However, as the priorities started to shift towards disinflation in the late 1980s, the government had to discontinue the real devaluation based exchange rate policy, because of cost push inflation generated by devaluation. Between 1984 and 1990, the Lira appreciated by 34 percent in real terms. Despite the real appreciation of the Lira, exports continued to increase in the second half of 1980s, and reached $13 billion in 1990.

Starting with 1987 elections Turkey went into a long period of political competition and populism which resulted in excessive use of government resources. As a result, budget deficits increased rapidly in the late 1980s. With rather small financial markets, then Primer Minister Turgut Ozal decided to open the capital account in 1989 in order to attract foreign portfolio investors and increase the funds available to finance public sector borrowing requirements. With liberalized capital account coupled with a controlled exchange rate regime Turkey attracted large sums of foreign capital flows in the first half of 1990s. During this period Turkish Lira became overvalued. As a result of the decline in direct and indirect export subsidies and the move away from the real devaluation policy, the export performance of Turkey had stalled throughout the 1990s. Only recently, following the worst economic crisis that hit the country in decades there has been a revival in the Turkish export performance. Total exports which stood around $31 billion at the end of 2001, now is expected to surpass $45 billions by the end of 2003.

When we analyze detailed export data of Turkey it becomes apparent that not only the total exports increased, but there has been a significant change in the composition of Turkish exports (using 4-digit SITC categories) over time. Following the Customs Union with the EU in 1996, the intra-industry trade has increased substantially. Moreover, those products that were not high in the export list have over time climbed up the ladder perhaps produced by plants that had not hitherto exported. These observations about the changing composition of Turkish exports suggest that it is not only the incumbent exporters exporting the same goods over time.

III. Empirical Analysis

A. Data

In this study we use a data set, collected by the Turkish State Institute of Statistics (SIS) for the Turkish manufacturing industry. SIS periodically conducts Census of Industry and Business Establishments (CIBE).[1] In addition, the SIS conducts Annual Surveys of Manufacturing Industries (ASMI) at establishments with 10 or more employees.[2] The set of addresses used during ASMI are those obtained during CIBE years. In addition, every non-census year, addresses of newly opened private establishments with 10 or more employees are obtained from the Chamber of Industry.[3] For this study we use a sample that matches plants from CIBE and ASMI for the 1990-96 period, for which export statistics was collected by the SIS surveys. Unfortunately, not all the key variables needed for this study have been collected for establishments with 10-24 employees.[4] Thus our sample consists of plants with 25 or more employees. Finally, we limit the sample to only *private establishments*.[5] In the resulting sample we have 35,432 plant years for 8,616 plants in 24 three-digit

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[1] Since the formation of the Turkish Republic, the CIBE has been conducted eight times (in 1927, 1950, 1963, 1970, 1980, 1985, 1992, and 2002).

[2] SIS also collects data on establishments with less than 10 employees. However, up to 1992 data on these establishments were collected only during CIBE years. Since then SIS has collected annual data for a sample of establishments with less than 10 employees.

[3] Thus plant entry can be observed in every year of the sample. Though not reported here, in the CIBE years we observe a larger number of new plants, and a higher fraction of smaller plants. Both of these observations reflect the concerted effort by the SIS to include all establishments in the CIBE years.

[4] Prior to 1992, 10-24 and 24+ size groups were administered different survey forms.

[5] The unit observed in the data is a plant, not a firm. However, in Turkish manufacturing sector, most of the plants are single plant establishments. For that reason, throughout the paper we use the terms “establishment” and “plant” interchangeably.

SIC industries for the period 1990-1996.

The data includes values of sales, number of employees, values of material inputs, electricity, fuels and investment. In 1991, the SIS started to collect information on exports of the plant and purchase of imported investment goods as well as domestic ones. Aside from these, information on various plant characteristics, such as R&D investment, purchase of licensed foreign technology, share of administrative, female and technical workers, are being collected since 1991.

B. Exporters and Non-Exporters

In Table 1, we present average annual entry rates into (and exit rates from) export markets for the whole manufacturing and five largest sectors. The entry rates are also calculated for four size groups to check the impact of plant size on export decision. Looking at the first column first row of the table we observe that 78.0 % of plants that exported in the past two years continue to export whereas only 22.0 % exit from the export market. The entry rate declines to 60.9 % if the plant exported last year (E_{t-1}) but not exported a year earlier (E_{t-2}). Export experience two years ago ($E_{t-2} = 1, E_{t-1} = 0$) has a weaker impact on export participation decision (the entry rate is only 34.0 % for those plants), but plants with no export experience at all in the last two years has a very low probability to participate in export markets. If a plant did not export in the last two years, it will not export in the current year as well with 92.3 % probability.

There seems to be a high degree of persistence in export status. Another way of measuring the degree of persistence is to compare the differences among the exporting and non-exporting plants' likelihood to export in the subsequent year. For example, on average, while only 10.3 % of non-exporting plants export in a subsequent year, this ratio is 74.1% among the exporting plants, indicating that exporters are 7.4 times more likely to export in the subsequent year than a currently non-exporting plant. A likelihood ratio of 7.4 (substantially greater than one) is a clear indication of persistence in exporting behavior.

A comparison of the export entry-exit patterns for Turkey with that of Columbia reported in Roberts and Tybout (1997) reveals that a change in status to become an exporter is easier in Turkey. Whereas only 3.3% of Colombian non-exporters become exporters in the subsequent year, in Turkey this rate is 10.3% for all manufacturing sectors, and 13.2% for the four major exporting industries. Turkey differs from Colombia also in terms of the ease with which to exit the export market. Approximately 25.9% of all manufacturing plants and 26.7% of all plants in the four major export industries that exported in a given year exit the export market in the consecutive year. For Colombia this ratio is only 12.8%.

In order to emphasize the role of sector and plant characteristics in determining the likelihood of becoming an exporter, we calculated export status transition probabilities for ISIC (Revision 2) 2-digit industries and four size groups based on plant's initial employment levels. There are significant inter-sectoral differences in export market entry and exit rates. For example, a textile plant (ISIC 32) that has no export experience in the last two years is almost five times more likely to export in the current year than a plant operating in non-metallic mineral products industry (ISIC 36). Export status seems to be less persistent in the textile industry which has the highest share of exporting plants (35.7 %) and export share in total output (see Table A1).

The period averages of transition probabilities for each size group are presented in Table 2. As we move from small to large plants (from size-based group 1 towards 4), the probability of exporting in the subsequent year increases, irrespective of the current export experience of the plant. However, it is more interesting to observe that the ratio of former exporters' and non-exporters' likelihoods to export in the current year is also decreasing with size. While in size-group 1 (25-49 employees) a former exporter ($E_{t-1}=1$, $E_{t-2}=0$ or 1) is 10.2 times more likely to export this year relative to a former non-exporter, in the largest size-group (250+ employees) this ratio drops to 3.8. The drop in the likelihood ratio with size shows that large plants have the resources, the scale and scope to overcome high sunk cost barrier to export markets.

Instead of calculating transition probability matrices for all categories determined on the basis of some other plant characteristics, we now turn to the investigation of the export participation decision in a multivariate setting.

C. Export Decision and Export History

The empirical analysis is based on a dynamic model of export market participation decision commonly used in the literature.[6] Here we briefly summarize the framework for empirical analysis. Assuming that a plant can always produce the profit maximizing level of output, its profit maximization problem is transformed into a decision to export or not. The plant's export decision today influences future profits and therefore future exports. It will choose to export today if the sum of current and expected future revenues from exporting exceeds the costs of entry today and possible future exit. Under these assumptions, export participation decision takes the following form:

$$E_{it} = \begin{cases} 1 & if\ \pi^*_{it} - F_{it}(1 - \tfrac{1}{2}\sum_j \sum_k \delta_{jk} E_{i,t-k} E_{i,t-j}) \geq 0 \\ & 0\ otherwise \end{cases} \tag{1}$$

where E_{it} is a binary variable that denotes whether or not the i^{th} plant is exporting in period t, π^*_{it} is the expected *gross* profit increment (not adjusted for the sunk costs of export market entry) that will

[6] For a more detailed treatment of the model see Roberts and Tybout (1987) and Bernard and Jensen (2004).

accrue to plant *i* if it were to export in period *t*, F_{it} is the sunk cost of entry/re-entry into export market, and δ_j is the proportion of the non-recurring part of the entry cost at time *t-j*. Thus, if a firm had already exported at time *t-j*, but not in any other time, sunk costs of exporting it incurs at time *t* will be δ_j percent less compared to a plant that had not exported at *t-j*. Interaction terms (δ_{jk}) are used to capture non-additive effects. Given that the maximum number of observations in our data set is 7, we limit the number of lags (*j*) to a maximum of 3. Equation 1 implies that plant *i* exports at *t* if profits from exporting net of (re-) entry costs is non-negative.

Our formulation of the export market participation decision in equation (1) differs from Roberts and Tybout's (1997) formulation. They are interested in the effects of sunk costs on export market participation decision. Our focus is wider than the sunk costs of entry. Instead of limiting the analysis with only sunk costs of entry, we are interested in studying how the history of a plant's export market participation affects the current export market participation decision. In other words, we ask whether the history matters for the current export decision. This framework allows us to differentiate not only between exporting and non-exporting plants in the previous year, but also between plants that have different export market participation records.

There are several reasons to expect the history of a plant's export market participation to matter for the current export decision. Cost savings due to past export market participation may well be generated through several different channels. Among these we can count productivity improvements driven by intense international competition, the establishment of long-term buyer-supplier relationships, existing and past exporters' preferential access to government-subsidized inputs and credit towards future exports, and increased familiarity with and reputation in export markets.[7] It is common practice for governments all around the world to use information about the past export performance of the plants in the allocation of quotas, licenses to import inputs with duty drawbacks, export credits, and export marketing subsidies.[8] In many cases the past experience means more than just exporting in the preceding year.

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[7] "Most foreign buyers prefer to give orders to firms that already have considerable export experience and require little instruction and assistance. This is one reason success is cumulative" (Thomas *et al* 1993, p. 128).

[8] Selective government support to exporting firms is a policy choice that has been observed in many countries.. As part of export-oriented growth strategy, since late 1950s the Taiwanese government granted credit lines to firms based on their past export performance and future plans (Aberbach, Dollar, Sokoloff, 1994). Korean government still provides small business export credit "to small & medium size companies that manufacture exporting goods or supply materials needed by their primary exporters on the basis of past export performance." The most important eligibility criterion for the South African government's Export Marketing Assistance (EMA) program is the firm's past export performance. Indian government is more explicit about what is meant by the past export performance: "Exporters having past export performance in the preceding three licensing years may also apply for Advance Licence and Advance Intermediate Licence.... An Advance Intermediate Licence (AIL) is granted to a manufacturer-exporter for the import of inputs required in the manufacture of goods to be supplied to the ultimate exporter holding an Advance Licence/Special Import Licence. " Export Import Policy 1997-2002 http://www.ieo.org/ex007.html

If all the costs (and benefits) of entering an export market are one-time sunk costs, then δ_j will be equal to 1 for the first year it exports. In such a case, the information on any prior export status would be sufficient to estimate the cost of entry at time *t*. For example, if the firm exported at time *t-1*, its export status at time *t-2* will not provide any additional information. However, as our discussion in the preceding paragraph shows, some of the costs (and benefits) of entry into export markets are recurring, possibly with a declining impact over time, i.e., $1 > \delta_1 > \delta_2 > 0$, and $1 > \delta_1 + \delta_2$.

At the beginning of period *t* the plant manager observes all available information and makes necessary calculations. Based on the level of expected net profits, s/he decides whether to export or not. As researchers we do not observe the incremental profits from exporting. Instead we observe the outcome of the manager's participation decision: E_{it}. We are going to estimate a dynamic discrete choice model where E_{it} is the dependent variable, and its lagged values $E_{i,t-1}$ and $E_{i,t-2}$ are among the explanatory variables. If the sunk costs of entry to export markets are negligible, then it wouldn't matter for the current export decision whether the plant had exported previously or not. Consequently, statistically significant coefficient estimates for the export participation dummy variables $E_{i,t-1}$ and $E_{i,t-2}$ would imply that sunk costs do actually matter for the current export market participation decision.

In order to capture the role of the history of export participation on the current export participation decision we allow for the interaction of $E_{i,t-1}$ and $E_{i,t-2}$ in our estimating equation. Statistically significant coefficient estimates for the interaction terms will be interpreted as evidence supporting the *history matters hypothesis*. A positive coefficient of the interaction term implies that there are super-additive returns (in terms of the probability of exporting at time *t*), whereas a negative coefficient indicates the existence of diminishing returns in participating export markets over time.

Aside from the binary variables as indicators of past export market participation, one needs to control for macroeconomic factor that influence plants' likelihood of becoming exporters. We use year dummies in order to control for the effect of real exchange rate movements, business cycle fluctuations and other possible macroeconomic shocks on export decision.

In a dynamic panel data model with unobserved firm-specific effects, as the model we used in this paper, the initial observations of the lagged dependent variable (E_{t-1} and E_{t-2} in our model) are not likely to be independent of unobserved effects. Therefore, the usual random effects logit estimator could be inconsistent and biased. Wooldridge (2003) has developed a new method to handle the initial observations problem. He proposes to include the initial value of the dependent variable and the mean values of the explanatory variables for each plant as additional explanatory variables. After obtaining the random effects logit estimators, we also regress the model with Wooldridge (2003) correction to check whether initial conditions correction matters in our case.

D. Plant Characteristics and the Export Decision

There is a wide range of possible plant characteristics that could affect the decision to export. In our estimations, we try to account for as many plant characteristics as possible for which we have data so as to have better estimates for the past export experience indicators. We start with the size variables. In previous research large plants were found to be more likely to become exporters than small plants. Under the presence of economies of scale (or scope) the size of the plant matters for average cost of production. To the extent that low cost plants enter the export market earlier, the size would matter for the export decision. We use employment as a measure of plant size. The quadratic employment term is also included in the model to account for non-linear effects (see Table A1 for descriptive statistics for all variables used in the model).

Another plant characteristic that we include in our regressions is the (log) real wage rate paid by the plant. Efficiency wage literature shows that plants tend to pay a wage rate above the market clearing wage rate in order to provide incentives for workers to show more effort. Another reason for paying higher wages is to attract and keep high quality labor. Those plants that take a special interest in paying higher wage rates are likely to be more efficient and/or produce better quality products. Consequently, if this linkage is strong one is likely to get a significant positive coefficient on the log wage rate.

We have data on direct measures of labor composition in terms of tasks and gender. In our regression, we include shares of administrative employees and female employees in plant's total labor force. If Turkish manufacturing plants are more competitive in activities that require home-based, "feminine" skills, the share of female employees will have a positive impact on export decision (see, for example, Özçelik and Taymaz, 2004). In a similar way, the coefficients of the variables on administrative employees will indicate if Turkish manufacturing plants are more competitive in non-production and technical skill intensive activities.

We also include a measure of the capital intensity of production. Turkey is a labor abundant country and as such has comparative advantage in labor-intensive sectors. However, this does not imply that less capital intensive plants are more likely to export. To the contrary, assuming that capital intensity is closely related to the technology level, plants with higher capital intensity can produce better quality products, attain lower unit cost of labor and, therefore, likely to become an exporter. In addition, plants with higher capital intensity are likely to use more advanced technology in both embodied and disembodied forms compared to less capital intensive plants. Advanced technology plays a critical role in producing higher quality products that would have better chance in international markets.

Capital intensity by itself is not sufficient as a measure of advanced technology use by a plant. In the case of Turkey how advanced the technology really is also depends on whether it's domestically produced or imported. For that reason we use a set of plant characteristics that are supposed to capture the impact of imported technology on the export decision. The first of these, the imported machinery share of capital stock is intended to measure the plant's reliance on embodied imported technology. Using aggregate data on manufacturing sector Mody and Yılmaz (2002) showed that facing with increased competition from low income competitors manufacturing sector producers in export-oriented developing countries invest heavily on imported machinery a means to increase labor productivity, and, hence, to lower unit costs while improving the quality of their products.

The second imported technology variable is the share of foreign ownership. The foreign direct investor brings not only the production know-how but also takes risks. However, from 1970s to 1990s a significant portion of the foreign direct investments attracted to the Turkish manufacturing industry aimed at taking the advantage of the relatively large domestic market. For that matter it is difficult to claim that the share of foreign ownership will raise the odds of exporting. As another measure, we use a dummy variable for plants that transferred technology from abroad through license or know-how agreements to analyze the impact of disembodied technology imports on export decision.

Finally, we include a measure for relative (labor) productivity to control for the effects of productivity on export decision. The "relative labor productivity" variable is defined by the logarithm of the ratio between the plant's labor productivity (value added per employee) and the average labor productivity of the relevant U.S. industry at the ISIC (Rev. 2) 4-digit level. Thus, this variable will test if those Turkish plants that perform well relative to the U.S. plants in the same industry are more likely to export.

As shown by Bernard and Jensen (1995) it is possible that the change in export status takes place contemporaneously with changes in one or more plant characteristics, such as plant size, employment composition and wages. In order to avoid the simultaneity problem that we cannot address directly, in our regressions we use one year lagged plant characteristics and spillover variables as explanatory variables.

IV. Empirical Results

Based on the export decision model summarized in equation (1) and the ensuing discussion, we estimate the following equation of export market participation using random effects logit regression:

$$E_{i,t} = \delta_1 E_{i,t-1} + \delta_2 E_{i,t-2} + \delta_{12} E_{i,t-1} E_{i,t-2} + \Phi \mathrm{S}_{i,t-1} + \Gamma \mathrm{Z}_{t-1} + \alpha_i + \varepsilon_{i,t} \qquad (2)$$

where the dependent variable is a binary variable, $E_{i,t}$, indicating the export status (1 for exporter, 0 for non-exporter) at *t.* The first three variables in equation (2) are the export status indicators for year *t-1* and *t-2* and their interactions with each other. Plant characteristics as of year *t-1* are all included in the vector $S_{i,t-1}$. Macroeconomic and sectoral factors (including time dummies) that influence the plant's export decision are summarized by the vector $Z_{,t-1}$. $\mathbf{\Phi}$ and $\mathbf{\Gamma}$ are the coefficient vectors for plant characteristics, and the macroeconomic and sectoral factors that have a potential influence on the export decision. α_is are the unobserved plant-specific effects, and $\varepsilon_{i,t}$ the error term.

The results of random effects logit estimation of Equation 2 for all manufacturing plants are presented in Table 2. The coefficient estimates for the exporter status at *t-1* and *t-2* are 2.698 and 1.538, respectively, whereas the coefficient estimate for the interaction term is –0.872 indicating that there are diminishing returns to export market experience. The logit model allows us to obtain the odds ratio (the probability of exporting at time *t*) as an exponential function of estimated coefficients. As a result it is possible to obtain the impact of a change in one of the variables (discrete or continuous) on the odds ratio. The odds ratios for all explanatory variables are also presented in Table 2.

In our framework, the empirical analysis of the "full history matters" hypothesis is more involved than just focusing on a single case of coefficient estimates and the corresponding odds ratios. We consider five possible cases where the effect of a plant's past export experience on its current year export decision needs to be analyzed. The five cases that are considered for the whole manufacturing industry (without and with the interaction term in the estimated export decision equation) as well as a selected group of two-digit ISIC sectors are all presented in Table 3.[9] In each case, we assume that there are two plants, *i* and *j*, that are identical in every aspect except for their past export market experience. The entries in Table 3 are the odds ratios (that is the ratio of plant *i*'s and *j*'s likelihood of exporting in the current year) under different scenarios about their export market experience considering a maximum lag-length of two years.

The first three lines of Table 3 compare plant *i*'s likelihood of exporting today that exported in either or both of the preceding two years with a plant *j* that has no experience with exporting in the preceding two years. First we consider the case where plant *i* exported in both periods *t-1* and *t-2*, whereas plant *j* did not in either periods. Everything else being the same, we can summarize scenario one by the following equalities: $E_{i,t-1} = E_{i,t-2} = 1$, and $E_{j,t-1} = E_{j,t-2} = 0$. In this case, with two consecutive years of export experience, plant *i*'s likelihood of exporting at *t* will be 28.9 (= $e^{\delta_1+\delta_2+\delta_{12}}$) times more than plant *j* that had no export experience in the last two years.

In Case 2 we observe that a manufacturing plant *i* that exported at *t-1*, but had not exported at *t-2* is 14.9 ($=e^{\delta_1}$) times more likely to export at *t* compared to a plant *j* that had no past export experience. In the third case, a manufacturing plant *i* that exported at *t-2*, but not at *t-1* is 4.7 ($=e^{\delta_2}$)

[9] In order to test the robustness of estimation results, the model is estimated separately for all ISIC 2-digit industries. Table 5 presents the odds ratios for 2-digit industries with more than 1000 observations.

times more likely to export at *t* compared to a plant *j* that had no past export experience.

The first three cases help us draw three conclusions. First, the degree of persistence in export market participation is actually stronger than previously shown. A comparison of the first case with cases 2 and 3, clearly shows that the longer is the past export market experience of a plant the higher its likelihood of exporting relative to a plant that has no experience in the preceding two years. Second, the more recent export market experience (at *t-1*) matters more for a plant's likelihood of export market participation than the export market experience further in the past (in our case, at *t-2*). The comparison of case 2 with case 3 clearly shows that the plant that exported more recently is more likely to export at *t*. Third, the interaction term has a negative coefficient that implies that there are "diminishing returns" to export market experience.

In the last two cases of Table 3 we compare a plant that exported at both *t-1* and *t-2*, with a plant that exported only at *t-2* (case 4) or only at *t-1* (case 5). Both cases support the results we obtain on persistence: Plants with longer export market experience are more likely to continue to exporting. While plant *i* that exported both periods is 6 times more likely to export at *t* compared to plant *j* that exported at *t-2* only, it is only 2 times more likely to export at *t* compared to a plant *j* that exported at *t-1*. A comparison of cases 4 and 5 support the result we obtain from a comparison of cases 2 and 3: The more recent export experience counts more. Plant *j* will be less disadvantageous relative to plant *i* in exporting at *t* if it exported at *t-1*, instead of *t-2*.

So far the odds ratios discussed in the previous couple of paragraphs are obtained from the export decision equation with the interaction term. Had we not included the interaction of the lagged indicator variables in our estimations, we would have followed Roberts and Tybout (1987) in interpreting the coefficient estimates and the corresponding odds ratios. In that case, we obtain coefficient estimates of 2.321 and 1.057 (see Table A2 in the Appendix) for the one- and two-lagged export indicators. These estimates are significantly lower than the estimates obtained with the interaction term in the equation. To interpret these coefficients and to see the difference that the inclusion of the interaction term makes, we compare the odds ratios in Table 3 obtained from the equation estimates with and without the interaction term.

From the equation without the interaction term we obtain the odds ratio for a plant that exported in both periods (Case 1) to be 29.3, a value which is not very different from the one that is obtained with the interaction term. When we compare the odds ratios with and without the interaction term in the equation for cases 2 through 5 the difference the inclusion of the interaction term makes becomes clear. When the interaction term is not taken into account the odds ratio for a plant that exported at *t-1* but not *t-2* (see case 2 under the "w/o interaction" column in Table 3) is 10.2 compared to 14.9 obtained when the interaction term is included. Similarly, when the interaction term is not included the odds ratio for a plant with export experience at *t-2* but not *t-1* is measured to be 2.9, much lower compared to the one obtained with the interaction term.

As the possibility of diminishing returns in export experience is accounted for, the estimated coefficients show that the previous year's (*t-1* or *t-2*) export experience actually matters more than is measured when the possible presence of additive effects are ignored. Leaving the interaction term out the product of the odds ratios in cases 2 and 3 is equal to the odds ratio in case 1 (29.3=10.2*2.9). This equality clearly shows that excluding the interaction term does not allow for the presence of diminishing returns in export experience. When the interaction term is included the product of the odds ratios for cases 2 and 3 far exceeds the odds ratio in case 1.

Another shortcoming of the specification without the interaction term is revealed in the equality of odds ratios in cases 2 and 3 to the odds ratios in cases 4 and 5, respectively. It basically means that the relative importance of one-lagged (*t-1*) experience is the same irrespective of whether the comparison is between a plant that exported in the last two years and a plant that exported at *t-2* only or it is between a plant that exported at *t-1* and a plant that had not exported in the last two years. The same is true for the two-lagged experience.

In the case of our specification with the interaction term a comparison of cases 2 and 3 with cases 4 and 5 reveals that the one-lagged or two-lagged past experience matters more when it is not coupled with the experience in the other period. In other words there are diminishing returns to export experience.

As can be seen in Table 3, the results we obtain for the manufacturing industry as a whole also apply to 2-digit ISIC sectors. Altogether these results are evidence supporting the presence of large sunk costs of entry to export markets as well as the role of the full history of export market experience. Plants that have never exported before faces large sunk costs when they enter the first time around. Plants that exported further in the past (at *t-2*) and stopped exporting in the meantime (at *t-1*) also face sunk costs of re-entry, which are not as high as costs of new entry. As can be expected, sunk costs are lower in the clothing and textiles (ISIC 32), the leading export sector throughout the period, and quite high in chemicals (ISIC 35), and non-metallic mineral products (ISIC 36) industries.

In order to test the relative importance of sunk entry costs for small and large plants, we estimated the model separately for four categories of plants (those employing 25-49, 50-99, 100-249, and 250+ employees). Since there the results are similar for the first and second as well as third and fourth groups (there seems to be a threshold around 100 employees), we re-estimated the model for only two groups, small (25-99 employees) and large (100+ employees) plants (Table 4). The estimation results indicate that the sunk costs are quite more important in influencing small plants export market participation decision. A small plant (employing 25-99 people) with two years of export experience is 30 times more likely to export at the current year than a small plant with no prior export experience. The same odds ratio is 25 for large plants (case 1, Table 4). The same pattern is also observed in comparing a plant with one year export experience with a plant with no experience (cases 2 and 3). However, if the plant has any export experience, the difference between small and large plants disappears (cases 4 and 5), In other words, the first experience in the export market makes the difference between small and large plants' exporting behavior.[10]

In order to test the robustness of our results from random effects logit model, we have estimated equation 2 using the initial conditions correction method proposed by Wooldridge (2003). The estimated odd ratios for export status variables are shown in Tables 3 and 4.[11] The coefficients of all export status variable (E_{t-1}, E_{t-2} and their interaction) turn out to be statistically significant. The odds ratios with initial conditions correction have the same pattern across industries and size categories as the random effects logit model without correction. However, the odds ratios for all five cases are much smaller and closer in magnitude to the empirical export probabilities presented in Table 1. With Wooldridge correction, the likelihood of exporting next year of a plant that exported two consecutive years is 10.4 times (an estimate close to one-third of the random effects logit estimate) that of a plant that had not exported in the last two years (Table 3).

As emphasized correctly by Roberts and Tybout (1997) the dependence of the lagged dependent variable on the unobserved firm-specific effects could possibly lead to estimates that exaggerate the role of sunk costs and the full export participation history. The comparison of the Wooldridge results with random effect logit results show that their conjecture was indeed correct for the Turkish manufacturing industry: Random effects logit model produces estimates that exaggerate the role of sunk costs when the lagged dependent variable is present on the right hand side. Despite the sharp decline in the odds ratio with the Wooldridge correction, their pattern and magnitude do still show that the full history of export participation matters for the current export decision and there are diminishing returns to experience in export markets. Therefore, our qualitative results are robust to initial observations correction.

Coefficients of other explanatory variables have usually the same signs, but, in some cases, are statistically insignificant, partly because of the fact that the mean values of the variables used in the model as additional explanatory variables lead to multicollinearity problem.

The change in odds ratios as a result of a switch in the binary variables or a one standard deviation increase in continuous variables for the whole manufacturing industry are presented in Table 3. The underlying random effects logit model estimates and standard errors are presented in Appendix Table A2. Estimation results for ISIC 2-digit industries with more than 1000 observations are also

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[10] We have also experimented with three-lags of the export status indicator (for the whole manufacturing industry, see Table A3) as well as two-digit ISIC sectors. These estimates also support our findings with two-lags of the export status indicator: the more recent export experience matters more. The length of the export market experience also matters.

[11] Full set of estimation results are available from the authors.

presented in Appendix Table A2 .

If sunk cost of becoming an exporter is so high how could it be possible for 10% (see Table 1) of the non-exporting plants to start exporting their products in a given year? As we have already discussed above, the presence of high sunk costs is actually the reason why factors that may possibly increase the odds of becoming an exporter have to be included in the analysis of the export decision. Plant characteristics such as the size (as measured by employment level), capital intensity of the production technology (as measured by the capital/labor ratio), labor productivity (relative to U.S. manufacturing industry) as well as the wage rate (as a measure of the efficiency labor) increase a plant's odds of becoming an exporter. As we expected the coefficient on the squared employment term is negative, implying that an increase in the employment will increase the probability of becoming an exporter at a decreasing rate.

A one standard deviation increase in log employment (which is equal to 0.955, the last column of Table 2) leads to a 229 % increase in the probability of a plant to become an exporter. Taking the quadratic effect of employment into account we obtain the net effect of the employment differences on the probability of becoming an exporter. If we take both effects of employment into account a standard deviation increase in both will generate a net increase of 50 % in the odds ratio (which is defined as $\exp(\phi_{labor} SD_{labor} + \phi_{laborsq.} SD_{laborsq})$. In other words, let's take two plants that are exactly the same in every characteristics but the employment level. If the plant with fewer employees has 10% probability of becoming an exporter, the plant with one standard deviation higher employment level will have a 15 % (1.5 times the plant with fewer employees) chance of becoming an exporter.

The coefficient estimates for 2-digit ISIC industries with large number of observations (32, 38, 31, 35 and 36) have the same sign as the whole manufacturing sector and in most cases they are statistically significant. However, the 2-digit SIC industries with fewer observations (37, 34 and 33) in general do not have coefficient estimates other than the current exporter status indicator that are statistically significant. For that reason at the 2-digit SIC level we focus on sectors with large number of observations.

Size effect (measured by employment level) on export status is larger in machinery and transport equipment (ISIC 38), and food and beverages (ISIC 31) compared to the clothing and textiles (ISIC 32) industry see (Table 5). While one standard deviation increase in lagged log employment (and employment-squared) leads to a 78% increase in the odds ratio of exporting in the clothing and textiles, in the case of food and beverages, and machinery and transport equipment industries the odds ratio for exporting at *t* increases by 588 % and 388 %, respectively (calculated from Table A2). Even though the coefficient estimates and hence the percent changes in odds ratios are quite high in the non-metallic minerals (ISIC 36) and chemicals (ISIC 35) industries (184% and 509%, respectively), they are not statistically significant. The coefficient estimate on quadratic employment term is negative for the industries considered above, but statistically significant only in the case of industries 38 and 31. When we incorporate the quadratic term the increase in odds ratio due to a standard deviation increase in log employment and squared log employment become 45 % in machinery and transport equipment industry (38) and 40 % in the food and beverages (31) industry.

While the wage effect is statistically significant for the whole manufacturing industry, a look at the two-digit ISIC industries reveals that it is significant only in the chemical (ISIC 35) and non-metallic mineral (ISIC 36) industries. We interpret this result to be an evidence that efficiency wage hypothesis with respect to export decision does not receive much support from the data for most of the sectors in the Turkish manufacturing industry.

Capital intensity of the production technology has a modest role in increasing the likelihood of exporting in the subsequent year. In the case of the whole manufacturing industry a one standard deviation increase in lagged K/L ratio raises the odds ratio of exporting at year *t* by 13 %. Among the two-digit sectors reported in Table A2, a one standard deviation increase in the K/L ratio influences the likelihood of exporting in the machinery and transport equipment (13 %) and food and beverages (38 %) industries only.

Relative labor productivity, as expected, boosts an average manufacturing plant's export orientation. A one-standard deviation increase in the relative labor productivity raises the probability of exporting by 13 %. The regression results for 2-digit industries indicate that a one-standard deviation increase the relative labor productivity increases the likelihood of exporting by 29 % in food and beverages (31), and by 10 % in clothing and textiles (32). The contribution of relative labor productivity to the export decision is statistically insignificant in other industries.

The next set of plant characteristics relates the export decision to the use of imported technology. Out of three variables covering various dimensions of imported technology (foreign license use, imported machinery use, and foreign direct investment), only imported machinery share of capital stock matters for the export decision for the manufacturing sector as a whole. However, a one-standard deviation increase in the imported machinery share of the capital stock increases the probability of exporting at *t* by a mere 8 %. Relative to other factors the impact of imported machinery is not large enough. Looking at the estimates at the 2-digit level, imported machinery share does have a significant positive impact on the export decision only in the machinery and equipment industry (18 % increase in odds ratio)

The last group of the plant characteristics we cover is the composition of the plant's employment. The estimates indicate that employment composition of a plant matters for the export decision. For the whole manufacturing sector, a one-standard deviation in the share of administrative employees reduces the probability of exporting next period by 6 %, whereas the increase in the share of female employees increases the exporting probability by 8 %. At the two-digit sector level, administrative employee share has an adverse effect on export decision in the textile and clothing (32) industry, and the female employee share helps improve a plant's chances of exporting substantially in the food processing (31), and the non-metallic minerals industry (36).[12]

V. Conclusions

We analyzed the export participation decision of Turkish manufacturing plants during 1990-1996. Our main results support the findings of previous contributions to the literature on export decision: Even after the correction a la Wooldridge (2003) for the initial conditions problem, sunk cost of entry to export markets was high for Turkish manufacturing plants. In addition to this main result, using data on quite diverse plant characteristics we show that despite the presence of high sunk costs of entry to export markets it is still possible for plants with certain characteristics to become exporters.

Our formulation of the export market participation decision differs from Roberts and Tybout's (1997) formulation, who are interested in the effects of sunk costs on export market participation decision. Instead of just the sunk costs we are interested in studying whether the full history of a plant's export experience affects the current export decision. In other words, we ask whether the history matters for the current export decision. In our empirical analysis we are able to differentiate not only between exporting and non-exporting plants, but also between plants that have different export market participation records.

Our findings are consistent with the results of Chlerides, Lach and Tybout (1998) which showed that initial entry to the export market involves some sunk costs and in the presence of these sunk costs exporting is a profitable activity only for high-productivity plants. We also show that there are sunk re-entry costs to those plants that quit the export market sometime in the past and try to enter the market again later on. In our first major finding we show that the longer is the past export market experience of a plant the higher its likelihood of exporting relative to a plant that has no prior export experience. Second, our formulation of the export decision equation that includes the interactions of the lagged dependent variable enables us to show that there are diminishing returns to export market experience. Last, but not the least, we also show that the more recent export market experience (at *t-1*) matters more for a plant's likelihood of export market participation than the export market experience further in the past (in our case, at *t-2*).

Aside from the past exporter status, several plant characteristics have crucial effect on export decision. First and perhaps foremost, plant size, measured by the employment level, matters for the export decision. As the size of plant increases the likelihood of being an exporter increases, but at a

[12] We included a number of other variables into our model to control for the effects of various types of spillovers (due to the presence of exporters, foreign firms, foreign technology users, etc.), but found that these variables have no significant impact on the export decision.

decreasing rate. Second, we use various measures of technological characteristics of plants to understand the relationship with export decision. First of these is the capital-labor ratio. Plants that use more capital-intensive technology have a higher likelihood of becoming an exporter. Furthermore, the higher is the imported share of machinery and equipment stock, the higher the likelihood of becoming an exporter. We are not able to find any support for the effect of foreign ownership and the use of licensed technology on export decision, at least for the period of our analysis, 1990-1996. Last but not the least, everything else being constant, the employment share of female employees enhances a plant's chances of export participation, while the share of administrative (white collar) workers diminishes it.

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Table 1. Empirical probability of exporting given the export experience (E) in the previous two years (%)

E_{t-1} E_{t-2}	All plants	ISIC 32	ISIC 31	ISIC 38	ISIC 35	ISIC 36
1 1	78.0	74.9	78.7	81.0	81.2	82.7
0 1	34.2	35.2	34.8	31.0	37.4	42.4
1 0	60.9	58.3	59.1	65.3	71.3	59.5
0 0	7.7	12.1	5.5	8.4	7.4	2.5
Number of observations	20182	5893	2990	4773	2157	1089
E_{t-1} E_{t-2}	Size 1 (25-49)	Size 2 (50-99)	Size 3 (100-249)	Size 4 (250+)	Size 1+2 (25-99)	Size 3+4 (100+)
1 1	70.5	74.6	78.3	85.4	72.5	82.2
0 1	29.5	35.5	34.7	41.8	32.2	37.3
1 0	54.1	60.8	60.8	74.2	57.0	66.2
0 0	5.3	7.7	12.1	16.6	6.1	13.5
Number of observations	8712	4837	3891	2742	13549	6633

Note: Size groups are determined by the employment level in the plant's first year in the data set. Plants with less then 50 employees are in size group 1, plants with 50- 99, 100-249 and more than 250 employees are included in size groups 2, 3 and 4, respectively.

Table 2. Determinants of export participation decision (All manufacturing plants, 1992-96, Random effects logit model)

Dependent variable: Exporter status at *t*	Var. type	Estimated coefficient	z-statistic	Odds ratio % change	Odds ratio % Std of X	Std. Dev. of X
Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)
Exporter status at *t-1* (E_{t-1})	0-1	2.698**	36.57	<u>1484.3</u>	350.3	0.465
Exporter status at *t-2* (E_{t-2})	0-1	1.538**	17.93	<u>465.5</u>	202.2	0.458
Interaction term E_{t-1}*E_{t-2}	0-1	-0.872**	-7.54	<u>41.8</u>	69.1	0.423
Log (labor)	Cont	1.247**	6.51	347.9	<u>329.0</u>	0.955
Log (labor) squared	Cont	-0.094**	-5.01	91.0	<u>40.8</u>	9.523
Log (wage)	Cont	0.137**	2.78	114.7	<u>110.7</u>	0.740
K/L ratio	Cont	0.094**	4.30	109.8	<u>113.0</u>	1.302
Relative labor productivity	Cont	0.102**	3.76	110.7	<u>113.0</u>	1.201
Foreign license use (dummy)	0-1	0.087	0.69	109.1	101.7	0.189
FDI (foreign owner's share, %)	Cont	-0.042	-0.27	95.8	<u>99.4</u>	0.152
Imported M&E (% of total)	Cont	0.333**	2.70	139.5	<u>107.6</u>	0.221
Admin. employees (% of total)	Cont	-0.382*	-2.05	68.3	<u>94.4</u>	0.150
Female employees (% of total)	Cont	0.346**	2.69	141.4	<u>108.1</u>	0.224
Log likelihood	-6059.9					
Number of observations	16441					

Notes: Dependent variable is the exporter status at *t*; The model includes year and 3-digit SIC sector dummies. **, * and + indicate that the coefficient is significant at the 1, 5, and 10% levels (two-tailed test), respectively. In the "Var. type" column "Cont." indicates the variable is continuous and its effect on odds ratio is measured after one standard deviation change (column 5). In the case of binary (denoted by 0-1) variables, the effect on odds ratio is measured in column 4 assuming that the variable is equal to one.

Table 3. The impact of (two-years) export experience on current export probability (Plant *i* vs Plant *j*, all manufacturing and ISIC 2-digit sectors)

			without interaction	with interaction					
Case	Plant *i*	Plant *j*	All Manufacturing	All Manufac.	ISIC 32	ISIC 38	ISIC 31	ISIC 35	ISIC 36
	E_{t-1} E_{t-2}	E_{t-1} E_{t-2}	Random effects logit						
1	1 1	0 0	29.3	28.9	19.5	32.9	34.8	37.8	97.7
2	1 0	0 0	10.2	14.9	9.8	17.7	17.2	25.6	42.3
3	0 1	0 0	2.9	4.7	3.7	3.7	5.8	5.7	38.2
4	1 1	0 1	10.2	6.2	5.3	8.8	5.9	6.7	2.6
5	1 1	1 0	2.9	1.9	2.0	1.9	2.0	1.48	2.3
	E_{t-1} E_{t-2}	E_{t-1} E_{t-2}	Random effects logit with initial conditions correction (Wooldridge)						
1	1 1	0 0	10.0	10.4	8.9	14.4	23.0	18.3	38.9
2	1 0	0 0	6.3	8.9	6.4	12.7	15.5	17.6	38.7
3	0 1	0 0	1.6	2.4	2.0	2.3	5.1	3.1	28.6
4	1 1	0 1	6.3	4.3	4.4	6.2	4.5	6.0	1.4
5	1 1	1 0	1.6	1.2	1.4	1.1	1.5	1.0	1.0

Table 4. The impact of (two-years) export experience on current export probability (Plant *i* vs Plant *j*, all manufacturing sectors and size categories)

Case	Plant *i*	Plant *j*	All Manufacturing	Size 1	Size 2	Size 3	Size 4	Size 1 +Size 2	Size 3 +Size 4
				25-29	50-99	100-249	250+	25-99	100+
	E_{t-1} E_{t-2}	E_{t-1} E_{t-2}	Random effects logit						
1	1 1	0 0	28.9	31.0	28.8	23.0	28.5	30.0	25.4
2	1 0	0 0	14.9	16.4	16.5	12.2	13.2	16.3	12.5
3	0 1	0 0	4.7	5.8	5.9	3.6	3.7	5.8	3.5
4	1 1	0 1	6.2	5.4	4.8	6.4	7.8	5.2	7.2
5	1 1	1 0	1.9	1.9	1.7	1.9	2.2	1.8	2.0
	E_{t-1} E_{t-2}	E_{t-1} E_{t-2}	Random effects logit with initial conditions correction (Wooldridge)						
1	1 1	0 0	10.4	11.2	14.1	9.7	18.5	15.0	12.5
2	1 0	0 0	8.9	10.0	11.1	7.5	11.2	11.7	8.7
3	0 1	0 0	2.4	2.9	3.2	2.0	2.7	3.3	2.2
4	1 1	0 1	4.3	3.9	4.4	4.8	7.0	4.5	5.6
5	1 1	1 0	1.2	1.1	1.3	1.3	1.7	1.3	1.4

Note: Size groups are determined by the employment level in the plant's first year in the data set. Plants with less then 50 employees are in size group 1, plants with 50- 99, 100-249 and more than 250 employees are included in size groups 2, 3 and 4, respectively.

Table 5. Percent Change in Odds Ratios, Random Effects Logit Model (ISIC 2-digit sectors)

	32	38	31	35	36
Exporter status at *t-1* (E_{t-1})	979**	1774**	1720**	2559**	4228**
Exporter status at *t-2* (E_{t-2})	369**	374**	585**	567**	3815**
Interaction term, $E_{t-1}*E_{t-2}$	54**	50**	35**	26**	-6**
Net log employment effect	126	145	140	131	170
Log (labor)	178+	688**	488**	284	6509
Log (labor) squared	71	20**	30**	46	28
Log (wage)	106	-96	95	147**	160+
K/L ratio	106	113*	138**	89	90
Relative labor productivity	110*	107	129*	-92	126
Imported license use (dummy)	-60	118	222	80	158
FDI (foreign owner's share, %)	101	98	89	105	95
Imported M&E (% of total)	106	118**	103	96	107
Admin. employees (% of total)	-92*	105	90	88	106
Female employees (% of total)	100	95	141**	87	148**
Log Likelihood	-2408	-1463	-705	-642	-217
Number of Observations	5031	4064	2439	1857	1543

Notes: **, * and + indicate that the coefficient is significant at the 1, 5, and 10% levels (two-tailed test), respectively. If the variable is continuous its effect on odds ratio is measured after one standard deviation change. If it is binary, the effect on odds ratio is measured assuming that the variable is equal to one

Appendix

Table A1. Descriptive statistics for the manufacturing industry and ISIC 2-digit sectors (1990-1996)

	All	ISIC 31	ISIC 32	ISIC 33	ISIC 34	ISIC 35	ISIC 36	ISIC 37	ISIC 38	ISIC 39
Current year's export dummy	0.2607	0.2271	0.3572	0.1362	0.1398	0.2464	0.1319	0.2562	0.2451	0.3127
Log (labor)	4.2557	4.2544	4.3241	4.0548	4.1700	4.2443	4.1898	4.2557	4.2386	4.0517
Log (wage)	2.3254	2.2395	2.0808	2.1592	2.2488	2.6523	2.1708	2.6560	2.6459	2.0985
K/L ratio	3.5078	3.4494	3.3979	3.3068	3.9093	3.9387	3.2759	3.8998	3.5194	3.2646
Relative labor Productivity	0.6501	0.3417	0.7505	0.5873	0.5419	0.6799	0.5555	0.8279	0.7147	0.5104
Agglomeration	0.2273	0.0774	0.3401	0.0955	0.3253	0.2557	0.0451	0.1200	0.2109	0.8286
Subcontracted input share	0.0290	0.0025	0.0604	0.0090	0.0250	0.0106	0.0081	0.0146	0.0223	0.0147
Subcontracted output share	0.0672	0.0110	0.1556	0.0263	0.0531	0.0233	0.0076	0.0450	0.0285	0.0285
Foreign license use	0.0269	0.0128	0.0061	0.0246	0.0182	0.0520	0.0137	0.0117	0.0653	0.0312
FDI share	0.0268	0.0366	0.0131	0.0099	0.0196	0.0589	0.0180	0.0107	0.0383	0.0184
Imported M&E share	0.1387	0.0789	0.1976	0.1070	0.2166	0.1479	0.0727	0.0920	0.1093	0.2130
FDI spillover	0.0775	0.1200	0.0241	0.0242	0.0493	0.1393	0.0234	0.0216	0.1508	0.0242
Patent spillover	0.1239	0.0575	0.0385	0.0893	0.0655	0.1858	0.0444	0.0271	0.3272	0.1611
Export spillover	0.4586	0.3772	0.5141	0.3317	0.2283	0.5483	0.3309	0.6673	0.4600	0.5002
Admin employee share	0.1945	0.2547	0.1441	0.1664	0.2591	0.2848	0.1495	0.1922	0.2070	0.1745
Female employee share	0.2236	0.2004	0.3914	0.1068	0.1283	0.1776	0.0877	0.0499	0.1279	0.2828
Technical employee share	0.1196	0.1109	0.0982	0.1208	0.1629	0.1336	0.1116	0.1211	0.1467	0.1081
FDI dummy	0.0436	0.0537	0.0211	0.0131	0.0315	0.0890	0.0291	0.0292	0.0670	0.0360

Note: Mean values for all observations for the period 1990-1996.

Table A2. Random effects logit model of export participation with and without interaction of the lagged dependent variable (Manufacturing industry and ISIC 2-digit sectors)

	All manufacturing plants				With interaction				
	1-lag	2-lags without interaction	2-lags With interaction	3-lags With interaction	ISIC 32	ISIC 38	ISIC 31	ISIC 35	ISIC 36
E_{t-1}	2.665**	2.321**	2.698**	2.780**	2.281**	2.876**	2.845**	3.242**	3.744**
	[0.053]	[0.052]	[0.070]	[0.099]	[0.111]	[0.144]	[0.217]	[0.214]	[0.397]
E_{t-2}		1.057**	1.538**	1.619**	1.306**	1.318**	1.766**	1.735**	3.642**
		[0.054]	[0.078]	[0.135]	[0.116]	[0.168]	[0.230]	[0.265]	[0.439]
E_{t-3}	---	---	---	1.357**	---	---	---	---	---
				[0.122]					
$E_{t-1}E_{t-2}$	---	---	-0.872**	-1.386**	-0.616**	-0.702**	-1.062**	-1.344**	-2.804**
			[0.105]	[0.181]	[0.159]	[0.226]	[0.317]	[0.345]	[0.590]
$E_{t-1}E_{t-3}$	---	---	---	-1.090**	---	---	---	---	---
				[0.199]					
$E_{t-2}E_{t-3}$	---	---	---	-1.169**	---	---	---	---	---
				[0.198]					
$E_{t-1}E_{t-2}E_{t-3}$	---	---	---	1.564**	---	---	---	---	---
				[0.273]					
	All plant characteristics listed below are as of *t-1*								
Log (labor)	1.509**	1.345**	1.247**	1.331**	0.586^{+}	1.994**	1.697*	1.121	1.939
	[0.194]	[0.202]	[0.203]	[0.241]	[0.313]	[0.380]	[0.681]	[0.688]	[1.509]
Log (labor) – squared	-0.107**	-0.103**	-0.094**	-0.107**	-0.035	-0.16**	-0.135*	-0.084	-0.139
	[0.019]	[0.020]	[0.020]	[0.024]	[0.031]	[0.037]	[0.068]	[0.069]	[0.147]
Log (wage)	0.174**	0.120*	0.137**	0.135*	0.1	-0.056	-0.081	0.497**	0.540^{+}
	[0.047]	[0.049]	[0.049]	[0.057]	[0.078]	[0.106]	[0.144]	[0.157]	[0.322]
Relative labor productivity	0.139**	0.108**	0.102**	0.063*	0.089*	0.061	0.205**	-0.078	0.194
	[0.024]	[0.026]	[0.026]	[0.030]	[0.038]	[0.059]	[0.066]	[0.088]	[0.198]
K/L ratio	0.140**	0.099**	0.093**	0.092**	0.049	0.105*	0.240**	0.083	-0.065
	[0.022]	[0.022]	[0.023]	[0.026]	[0.036]	[0.048]	[0.065]	[0.079]	[0.130]
Foreign license use	0.121	0.096	0.087	0.056	-0.518	0.163	0.797	-0.22	0.457
	[0.123]	[0.124]	[0.125]	[0.143]	[0.366]	[0.186]	[0.548]	[0.293]	[0.993]
FDI (foreign owner's % share)	0.092	-0.003	-0.042	-0.008	0.143	-0.095	-0.73^{+}	0.217	-0.399
	[0.149]	[0.148]	[0.148]	[0.172]	[0.366]	[0.269]	[0.406]	[0.335]	[0.766]
Imported M&E (% of total)	0.375**	0.334**	0.333**	0.349*	0.218	0.862**	0.164	-0.201	0.417
	[0.125]	[0.123]	[0.123]	[0.143]	[0.175]	[0.263]	[0.432]	[0.429]	[0.747]
Admin. employees (% of total)	-0.443*	-0.394*	-0.382*	-0.569**	-0.694*	0.356	-0.634	-0.642	0.473
	[0.177]	[0.186]	[0.187]	[0.221]	[0.332]	[0.395]	[0.511]	[0.475]	[1.207]
Female employees (% of total)	0.647**	0.370**	0.346**	0.326*	-0.007	-0.371	1.360**	-0.904	3.025*
	[0.123]	[0.130]	[0.130]	[0.156]	[0.176]	[0.380]	[0.309]	[0.584]	[1.178]
Log likelihood	-8480.5	-6093.9	-6059.9	-4339.7	-2407.7	-1462.5	-704.6	-641.9	-217.3
Number of obs.	22475	16441	16441	11661	5031	4064	2439	1857	1543

Notes: Dependent variable is the exporter status at *t*; the model includes year and sector dummies; standard errors are in brackets.
**, * and $^{+}$ indicate that the coefficient is significant at the 1, 5, and 10% levels (two-tailed test), respectively.

Table A3. The Impact of (3-years) Export Experience on Current Export Probability (Plant *i* vs Plant *j*, All manufacturing sectors

Case	Plant *i*			Plant *j*			With interaction		Without interaction	
	E_{t-1}	E_{t-2}	E_{t-3}	E_{t-1}	E_{t-2}	E_{t-3}	RE Logit	RE Logit (Wooldridge)	RE Logit	RE Logit (Wooldridge)
1	1	1	1	0	0	0	39.4	15.9	36.1	12.3
2	1	1	0	0	0	0	20.3	11.7	17.7	8.9
3	1	0	1	0	0	0	21.1	11.3	17.7	8.4
4	0	1	1	0	0	0	6.1	3.3	4.2	2.0
5	1	0	0	0	0	0	16.1	11.8	8.7	6.1
6	0	1	0	0	0	0	5.0	3.4	2.0	1.5
7	0	0	1	0	0	0	3.9	2.6	2.0	1.4
8	1	1	1	0	0	1	10.2	6.2	17.7	8.9
9	1	1	1	0	1	0	7.8	4.7	17.7	8.4
10	1	1	1	1	0	0	2.4	1.3	4.2	2.0
11	1	1	1	0	1	1	6.5	4.8	8.7	6.1
12	1	1	1	1	0	1	1.9	1.4	2.0	1.5
13	1	1	1	1	1	0	1.9	1.4	2.0	1.4